UNIVERSITY OF ILLINOIS EXTENSION

GROWING A NEW GENERATION OF ILLINOIS FRUIT AND VEGETABLE FARMERS

IRRIGATION

Jeff Kindhart and Jeremy Shafer

April 2014

new ILLINOIS fruit & vegetable FARMERS

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Irrigation gun with reel cart

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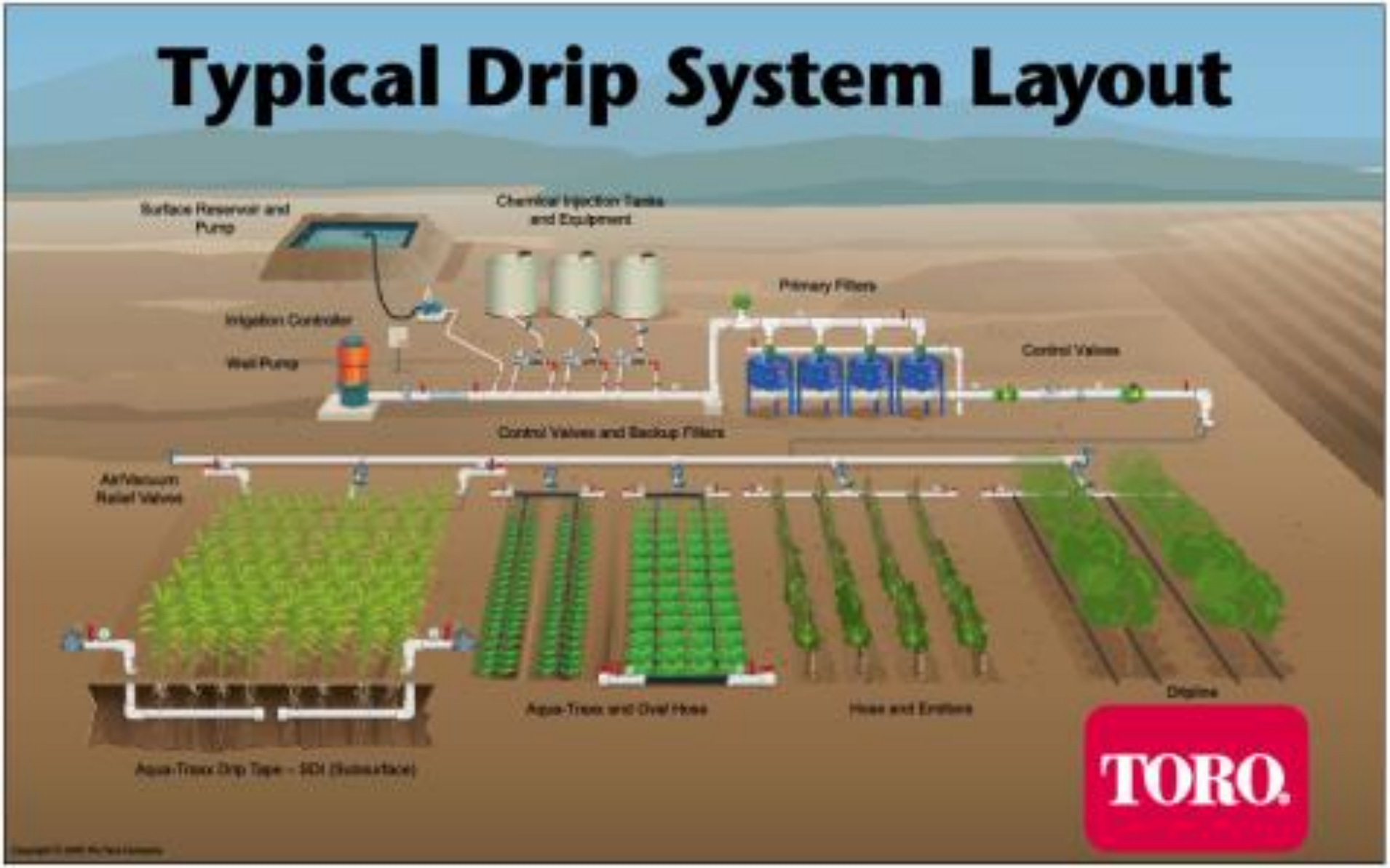
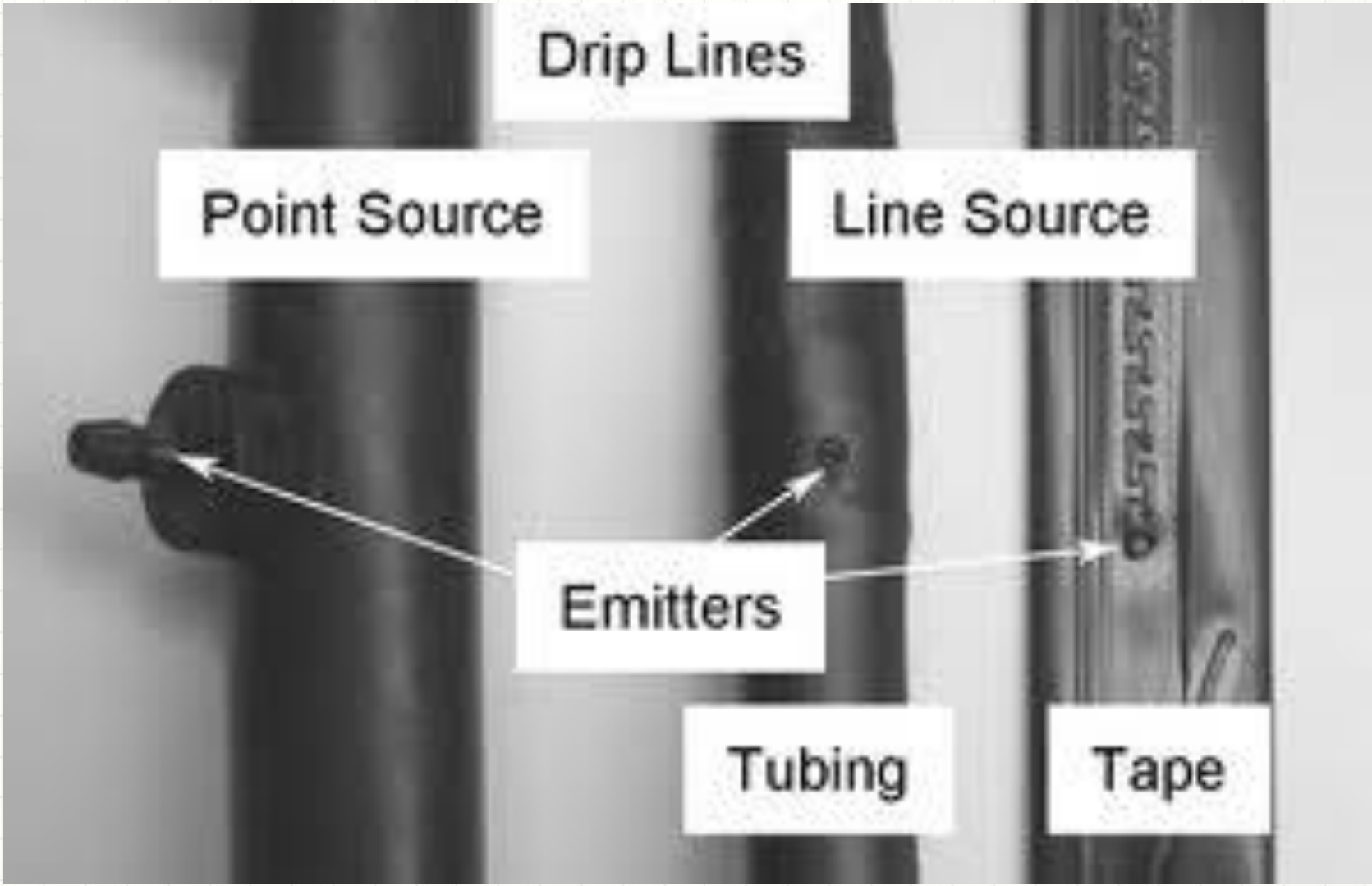
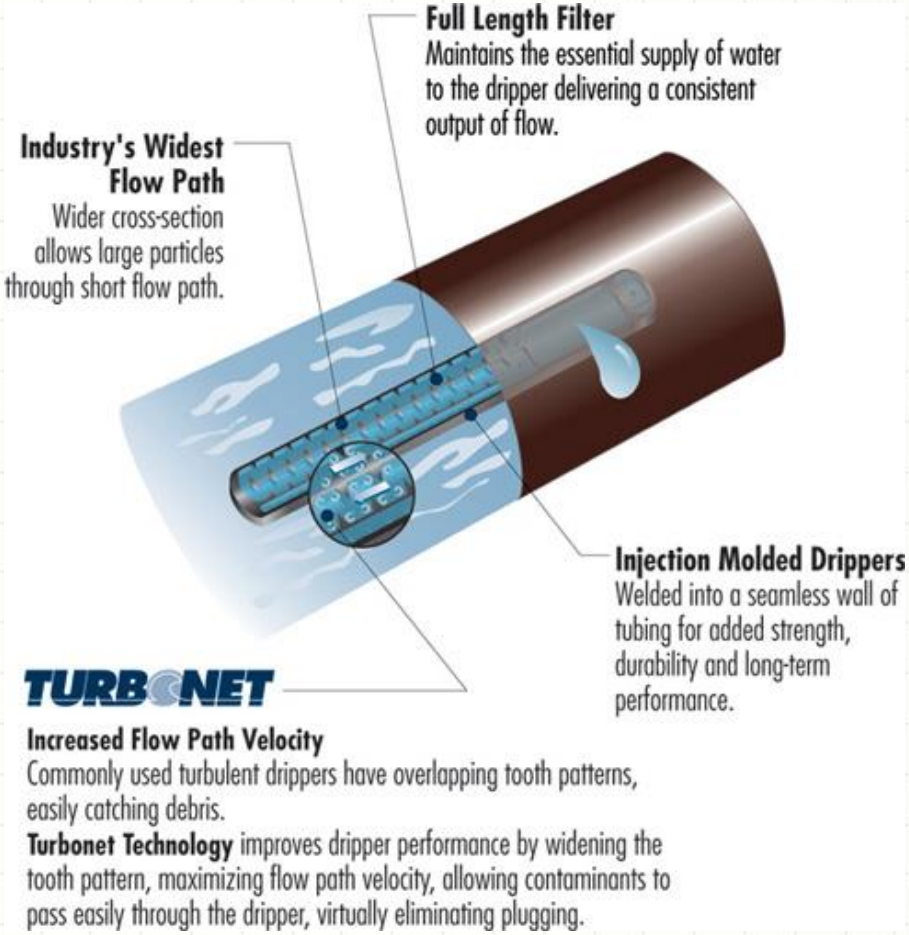
Typical Drip System Layout







SPECIFICATIONS

Wall thickness (mil):

- 0.540" (45 mil)
- 0.620" (45 mil)
- 0.690" (48 mil)
- 0.820" (60 mil)

Nominal flow rates (mil): 0.26, 0.4, 0.5, 1.0, 2.0

Common spacings: 18", 24", 30", 36", 42", 48", 60"

Recommended filtration: 120 mesh

Recommended operating pressure: 10 to 30 psi

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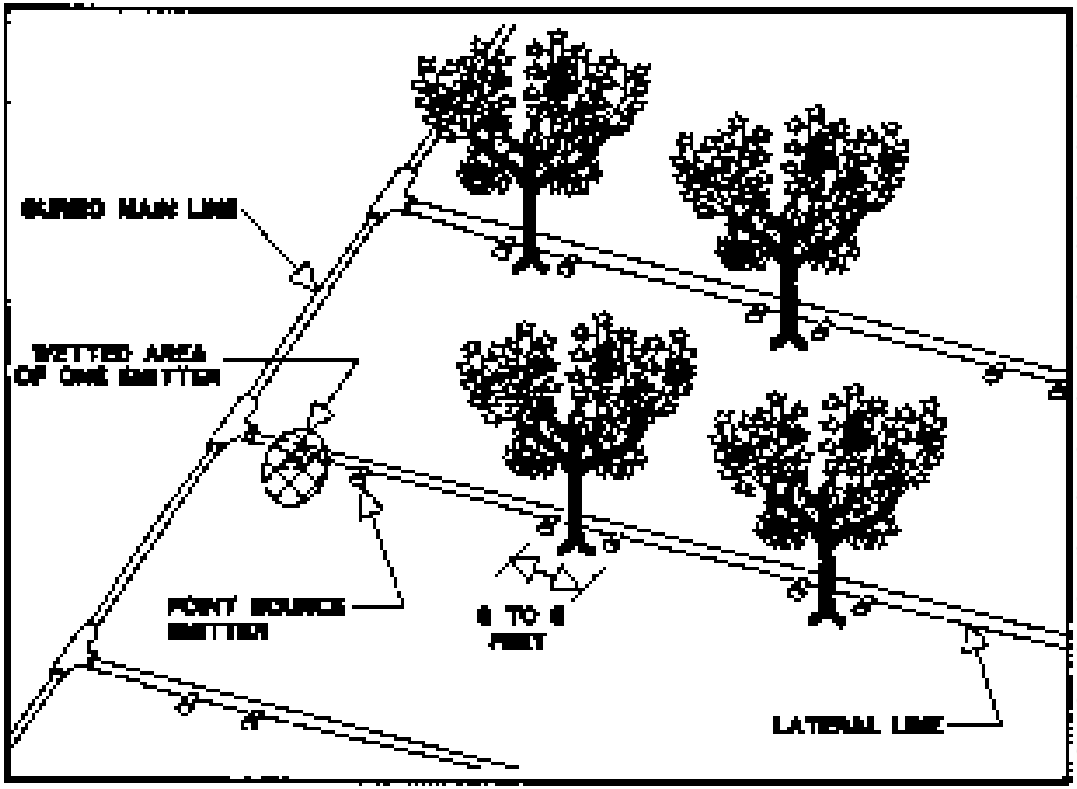

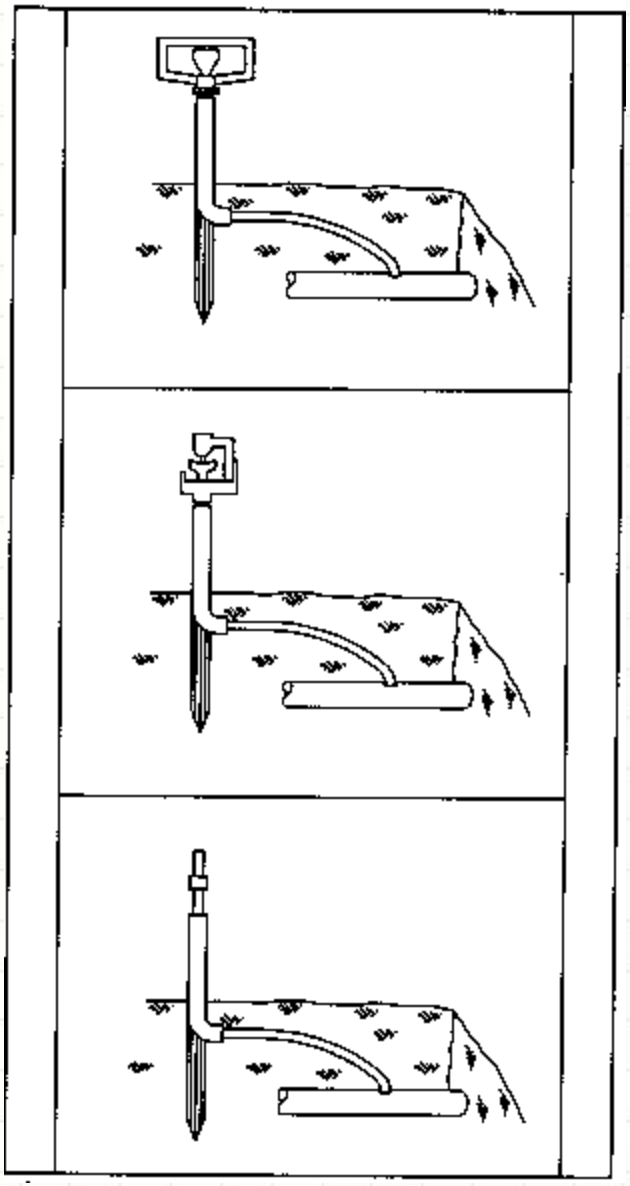

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Types of Problems

- Water Source
- Design
- Operation and Maintenance
- Other

Water Source Problems

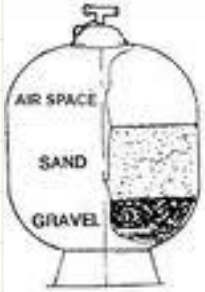
- Surface
  - Herbicide contamination
  - Disease organisms
  - Size
  - Excessive algae
- Well
  - Size/Capacity
  - Iron
  - Sand
- Municipal
  - Volume/Pressure

Surface Water Problems

Algae Problems

Algae Solutions

Sand Filter Diagram



Two TR60 Filters w/ Manifold

Single Filter Backwash Valve

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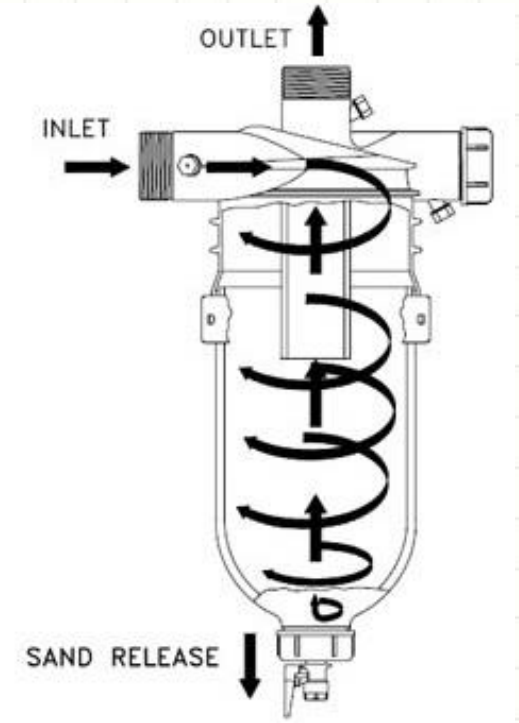

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Water Source Problems

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RPZ Backflow Preventer

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FLOW RATE					
GPM	**3/4”**	**1”**	**1-1/2”**	**2”**	**% Error**
MIN	0.5	0.75	1.5	2	3
MAX	30	50	100	160	1.5
CONTINUOUS	15	25	50	80	
RANGE	**2-30**	**3-50**	**5-50**	**8-160**	

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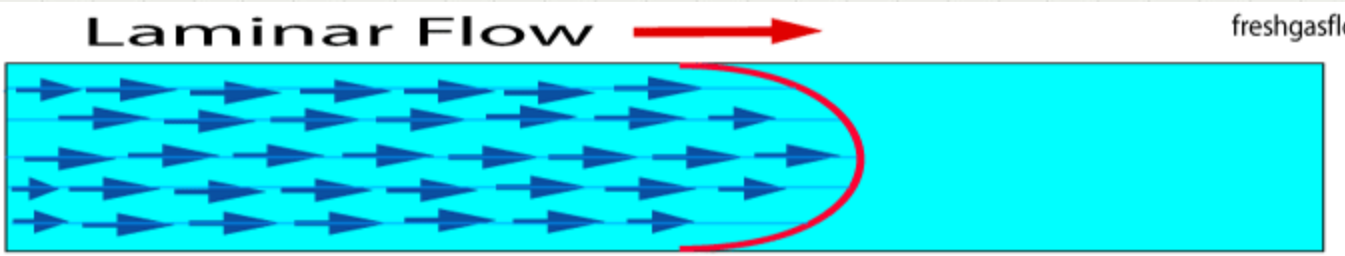
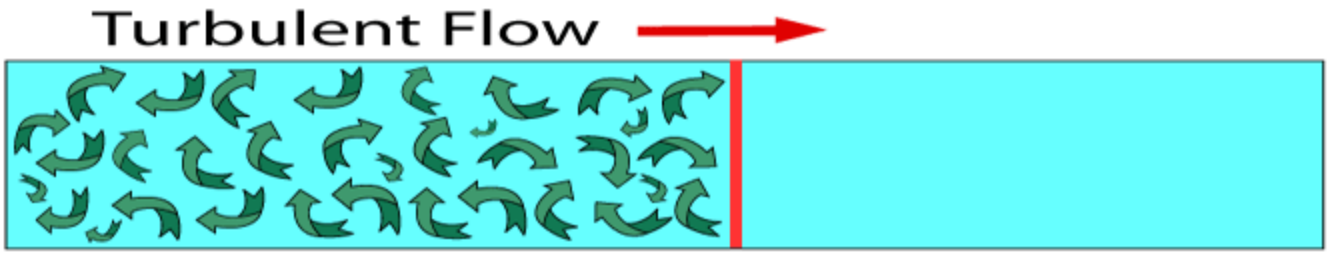
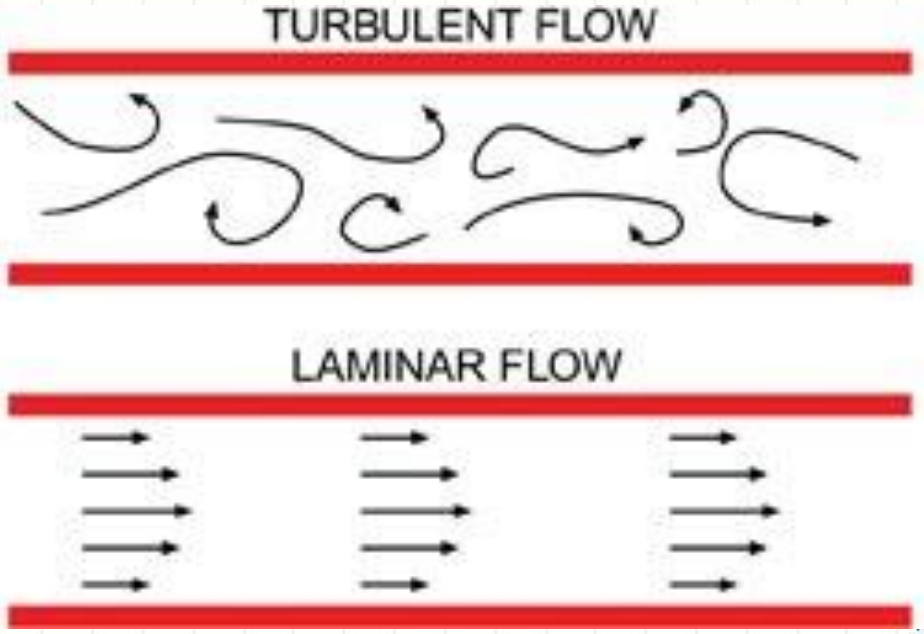
Flow rate and friction head loss for tubing and pipe sizes (Imperial) (based on 10 ft/s velocity)			
Nom. dia. (in)	Inside dia. (in)	Flow rate (gpm)	Friction head loss (feet of head per feet of pipe)
1/4	0.311	2.4	2.15
1/2	0.527	6.8	1.08
3/4	0.745	13.6	0.69
1	0.995	24	0.48
1 1/2	1.6	63	0.26
2	2.067	105	0.19
2 1/2	2.469	149	0.15
3	3.068	230	0.117
4	4.026	400	0.084
6	6.065	900	0.051
8	8.125	1615	0.036
10	10.25	2570	0.027
12	12.25	3675	0.022
14	13.5	4460	0.0194







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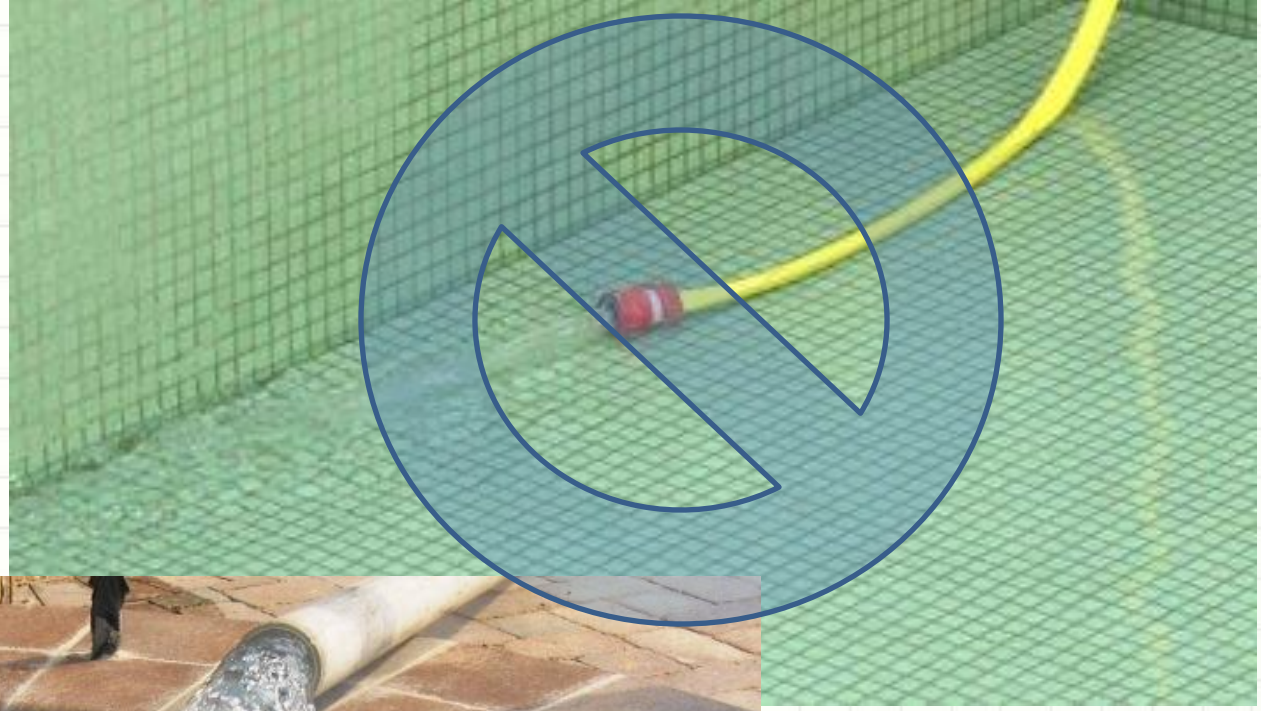

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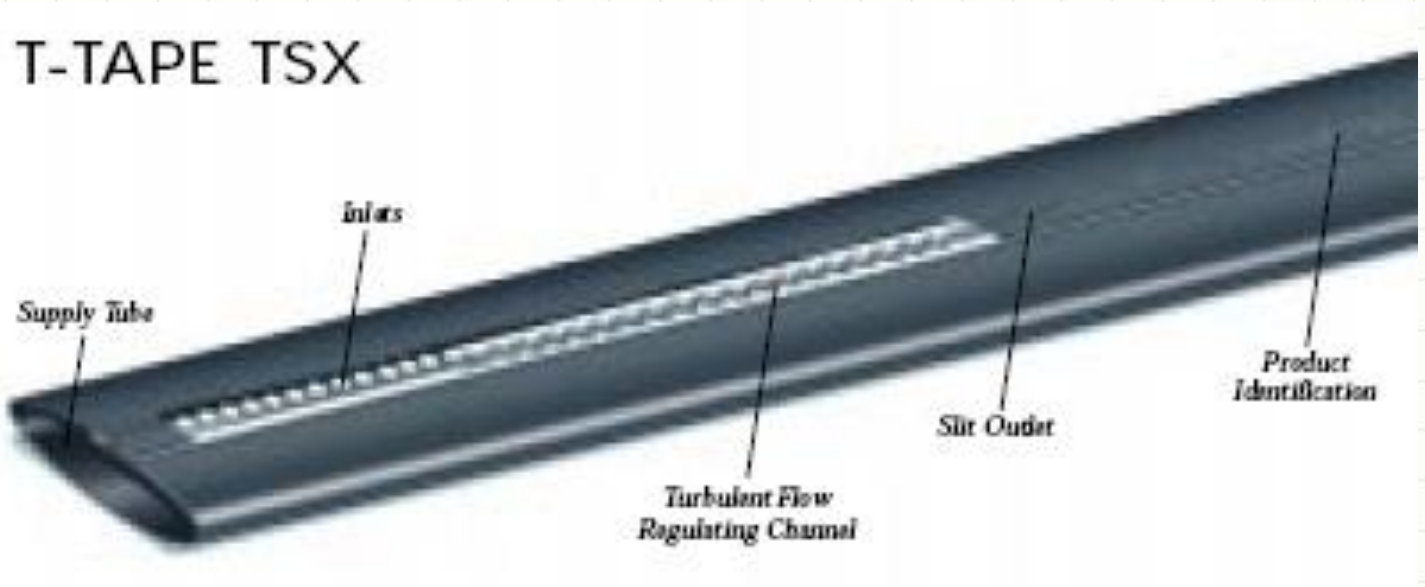
T-TAPE TSX



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T-TAPE PRODUCT IDENTIFICATION

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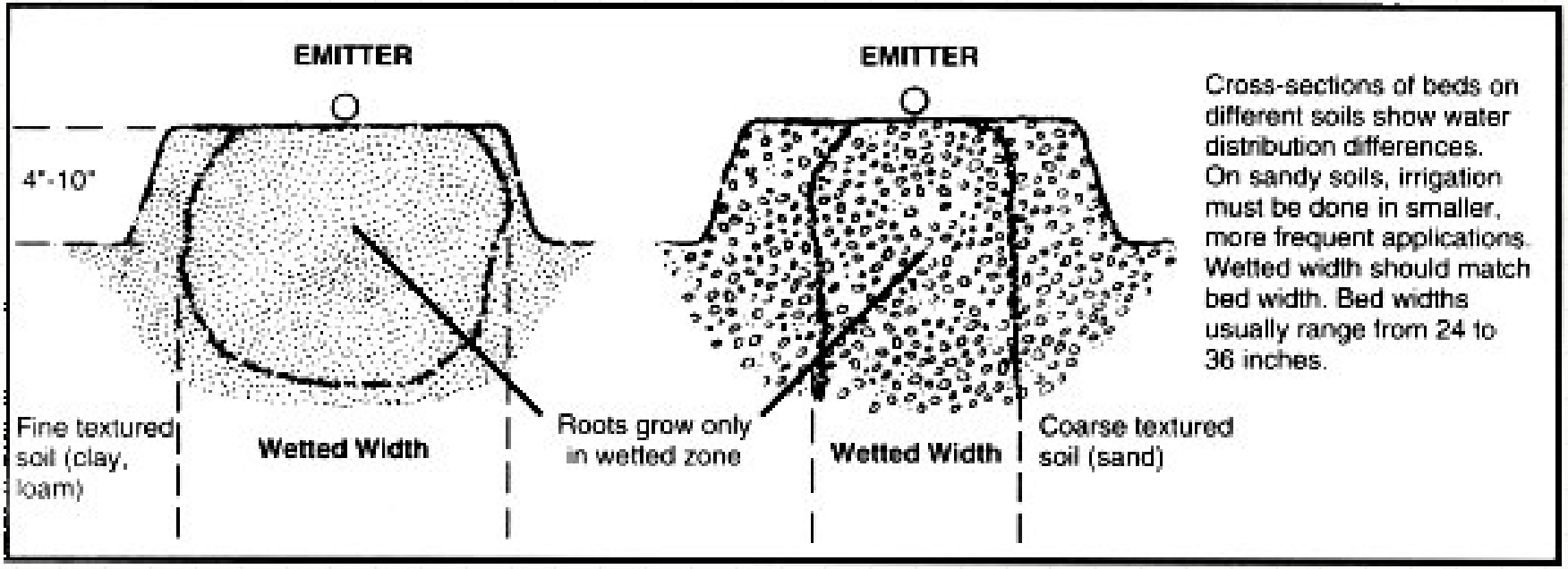

Cross-sections of beds on different soils show water distribution differences. On sandy soils, irrigation must be done in smaller, more frequent applications. Wetted width should match bed width. Bed widths usually range from 24 to 36 inches.

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Outlet Spacing

4, 6, 8, 12, 16, 18 & 24 inch spacing available for most T-TAPE TSX wall thicknesses.

Contact your T-TAPE dealer for a complete product listing.

Flow Rates

Various flow rates available to meet specific application needs.

Common Flow Rates

.170 . . . . . .gpm/100 Ft.
.220 . . . . . .gpm/100 Ft.
.280 . . . . . .gpm/100 Ft.
.340 . . . . . .gpm/100 Ft.
.450 . . . . . .gpm/100 Ft.
.670 . . . . . .gpm/100 Ft.

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E Ernest

Types of Problems

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Clogging Emitters

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Clogging Emitters

- Physical
  - Silt
  - Sand
- Biological
  - Bacteria
- Chemical
  - Calcium, magnesium, iron, and manganese
  - Fertilizer

Constituent	Level of Concern		
	Low	Moderate	High
pH	<7.0	7.0-8.0	>8.0
Iron (Fe) mg/L	<0.2	0.2-1.5	>1.5
Manganese (Mn) mg/L	<0.1	0.1-1.5	>1.5
Hydrogen Sulfide (H_2S) mg/L	<0.2	0.2-2.0	>2.0
Total Dissolved Solids (TDS) mg/L	<500	500-2000	>2000
Total Suspended Solids (TSS) mg/L	<50	50-100	>100
Bacteria Count (#/ml)	<10,000	10,000-50,000	>50,000

Solutions

- a method of filtering the irrigation water.
- a means of injecting chemicals into the water supply.
- in some cases a settling basin to allow aeration and the removal of solids.
- equipment for flushing the system.

Most Common Problem

- Management
- Management
- Management

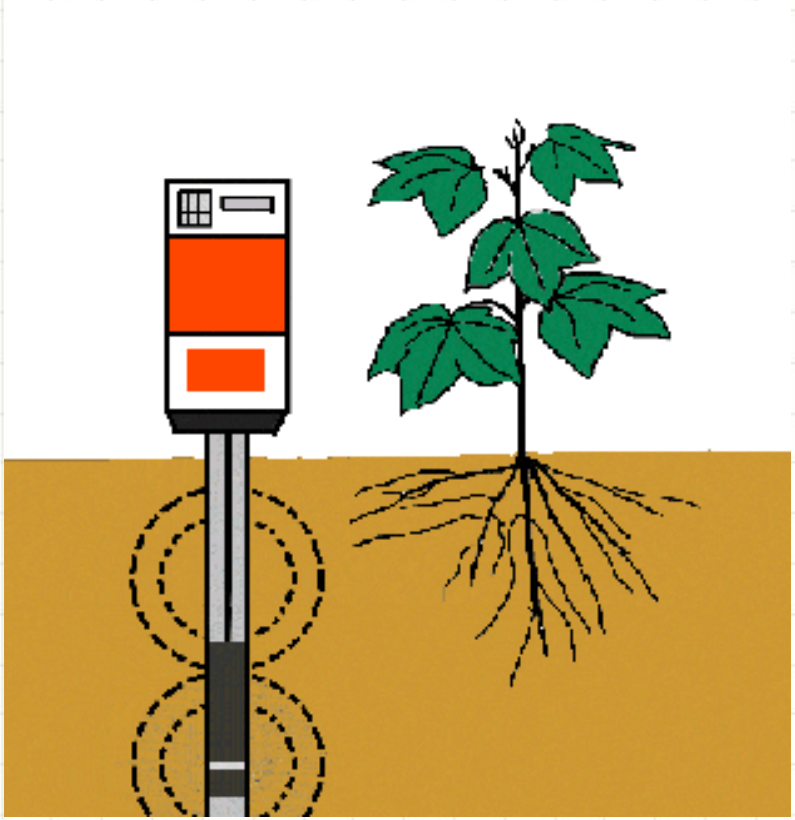
Monitor soil moisture

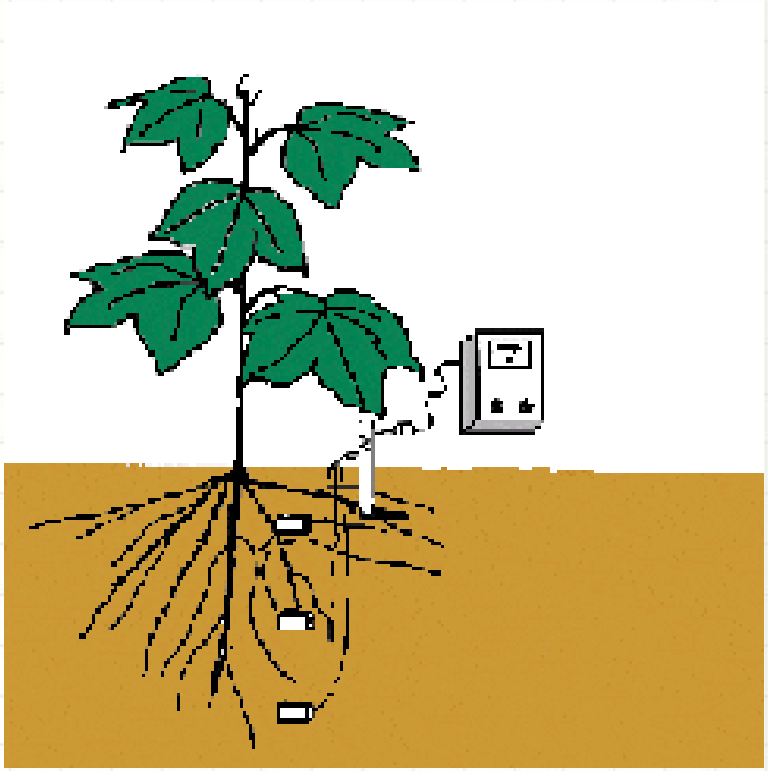
Factors that influence soil moisture

- Sun
- Wind
- Rain
- Temp
- Relative humidity
- Crop removal

Soil Moisture Monitoring Techniques

- The "Feel Method"
- Neutron Probe
- Electrical Resistance
- Soil Tension
- New Technology
- Plant Indicators
- Computerized Irrigation Scheduling





HERMETICALLY SEALED GAUGE
Accuracy and long gauge life are insured by a hermetically sealed neoprene cover with a molded-in diaphragm which keeps out dirt and moisture and compensates for variations in temperature and barometric pressure. (Pat. 2773388) (Pat. 3394594)

AIR-FREE GAUGE
The water seal prevents air from entering gauge, as gauge and chamber remain full regardless of water level in instrument.

THE IRROMETER BODY
is constructed of tough durable plastic impervious to attack by soil chemicals or electrolysis.

The IRROMETER is available in standard lengths of 6, 12, 18, 24, 36, 48 & 60 inches.

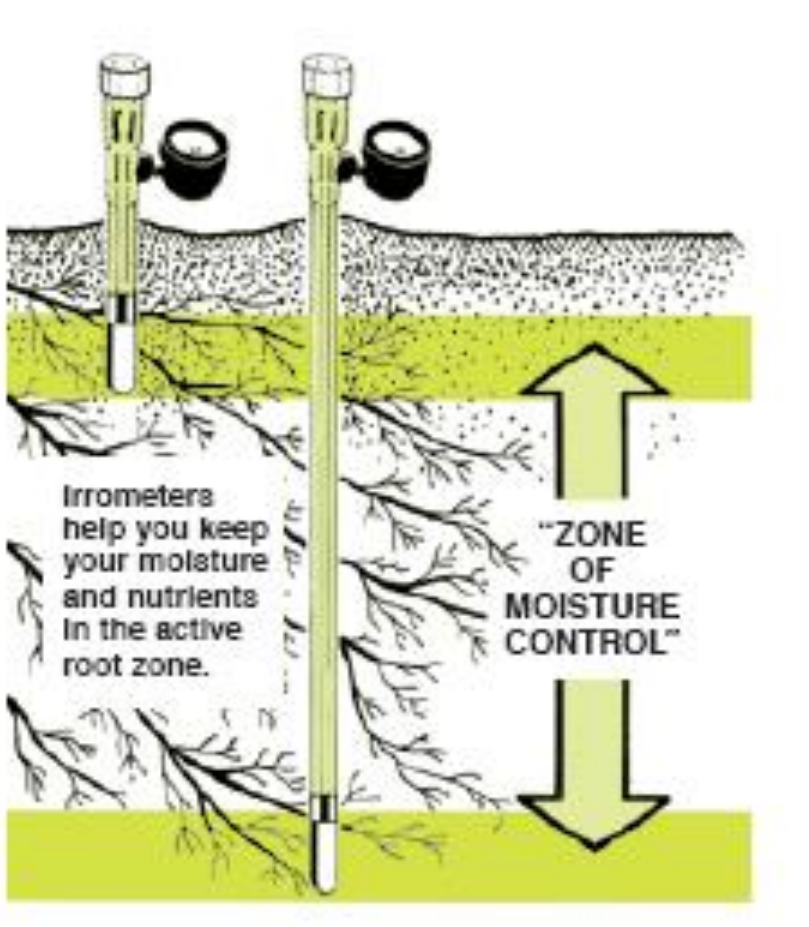
CLOSURE
Large cap for easy operation and better control. Cap removed when filling reservoir. Submerged valve gives a positive leakproof seal. Servicing is instantaneous—a twist of the wrist.

RESERVOIR
Holds a reserve supply of fluid sufficient for several irrigation cycles under average operating conditions. Unscrewing cap part way releases air and fills tube. (This is to replace fluid lost by action of drying soil.) (Pat. 2878671)

ALL SOLVENT WELDED JOINTS ARE PERMANENTLY LEAKPROOF

CERAMIC TIP
Has many times the strength of conventional tips. It is more porous to give quick response to variations in soil moisture.

MODEL "SR" (not pictured)
Threaded tip connection make tip replacement easy. Uses o-ring seal.



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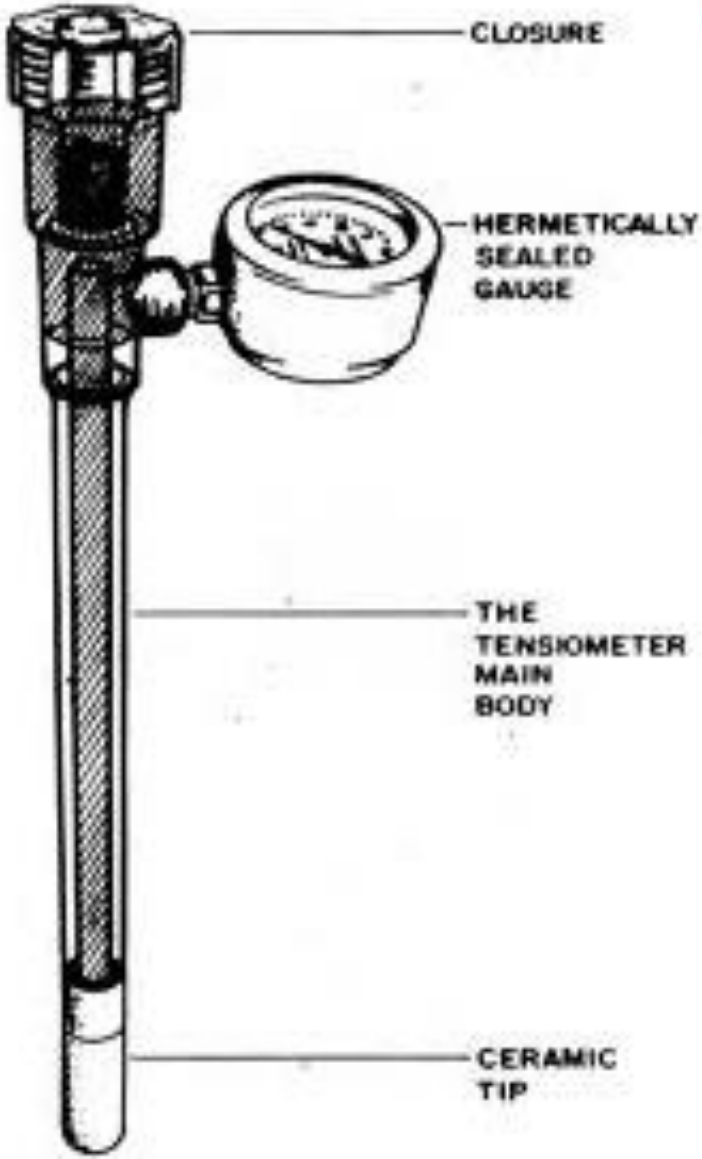

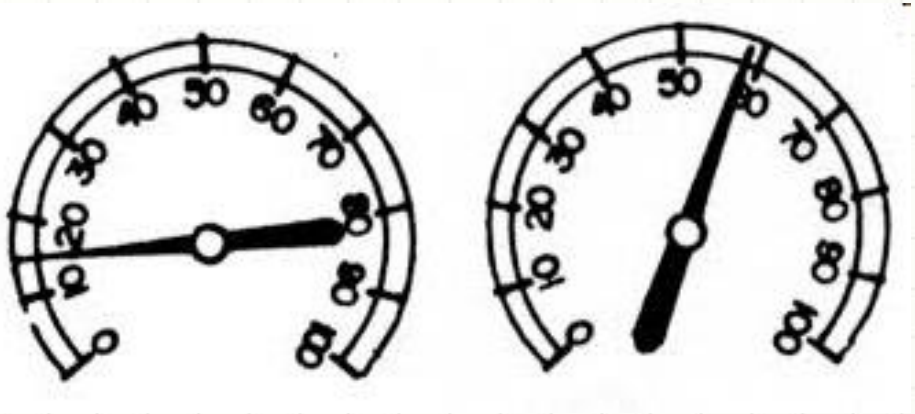

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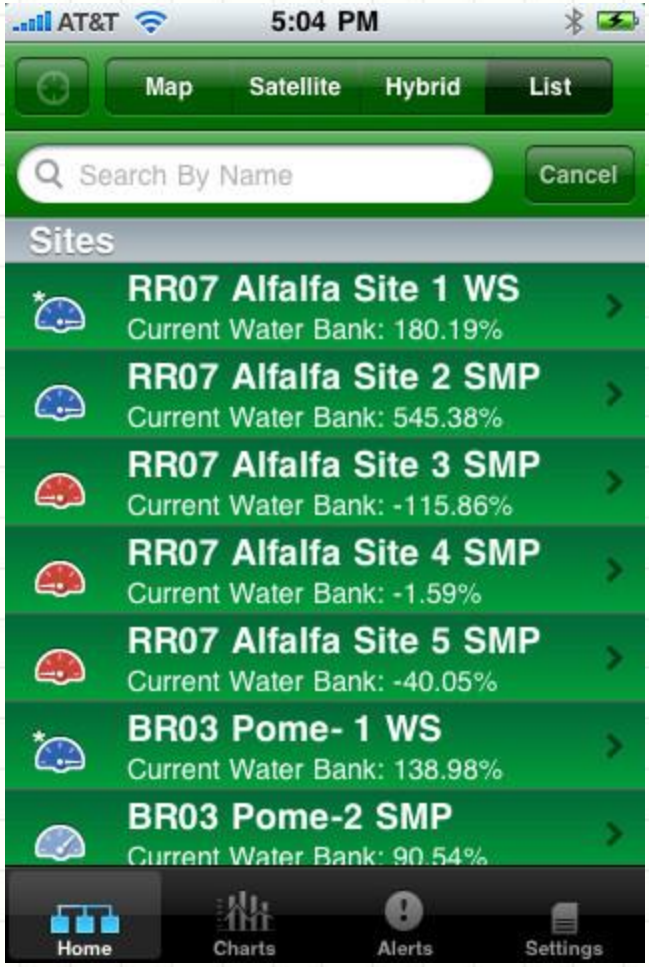
CROP	Shallow Instrument (Inches)	Deep Instrument (Inches)	For Extra Depth, Set at (Inches)
Alfalfa	18-24	36-48	60-70
Almonds	24	48	72
Apples	20	40	60
Apricots	24	48	72
Artichokes	18	36	
Asparagus	18-24	36-48	
Avocados	12	24	36
Bananas	12	24	
Barley	18	36	
Beans (bush)	10		18
Beans (Lima)	18	36	
Beans (Pole)	18	36	
Beets (sugar)	18	36	
Beets (table)	12-18	24-36	
Blueberries	12	24	
Broccoli	12	20	
Cabbage	12	20	
Canaigre	18	36	48
Cantaloupe	18	36	
Carnations	12	(Placed 4-6")	
Carrots	12	24	
Cauliflower	12	24	
Celery	10	20	
Chard	12	24	
Cherries	24	48	
Christmas tree	12	24	
Citrus; orange, lemon, grapefruit	18	36	
Coffee	18-24	36-48	
Corn (sweet)	12	30	
Corn (field)	18	36	
Cotton	18	36	48
Cranberries	18	36	
Cucumbers	18	36	
Date palm	24	48	60
Egg Plant	12	24	
Figs	18	36	
Garlic	12	24	
Grain and Flax	18	36	
Grapes	24	48	60
Hops	24	48	60
Jojoba	18	36	
Kiwi	18	36	48
Ladino Clover	10	20	
Lettuce	12		
Macadamias	12	24	36
Maize	18	36	
Melons	18	36	
Milo	24	48	
Mint	12	24	
Monterey Pines, Firs	12	24	
Mums	12	(Placed 4-6")	
Mustard	18	36	
Nectarines	18	36	
Oats	18	36	
Okra	18	36	
Olives	24	48	60
Onions	12		
Papaya	12	24	
Parsnips	18	36	
Peaches	18	36	60
Peanuts	12	24	
Pears	18	36	48
Peas	18	36	
Pecans	18	36	48
Peppers	15	30	
Permanent Pastures	8-15		24-30
Persimmons	18	36	
Pineapple	15	30	
Pistachio Nuts	24	48	60
Pomegranates	18	36	
Potatoes (Irish)	8-10	18	
Potatoes (Sweet)	18	36	
Plums	24	48	72
Prunes	24	48	72
Pumpkin	18	36	48
Radishes	12		
Raspberries	18	36	
Sorghum	18	36	
Soy Beans	18	36	60
Spinach	12	24	
Squash (Summer)	15	30	
Strawberries	6	12	
Sudan Grass	18-24	36-48	
Sugar Cane	18	36	
Sunflowers	24	48	60
Tea	12	24	
Tobacco	8-15	30	
Tomatoes	18	36	
Turnips	18	36	
Walnuts	24	48	72
Watermelon	18	36	48
Wheat-Hay	18	36	

Table 2. Soil Water Deficit Estimates for Different Soil Textures and Selected Tensions							
Soil Texture	Soil Tension in Centibars						
	10	30	50	70	100	200	1500*
	Soil Water Deficit - Inches Per Foot of Soil						
Coarse sands	0	0.1	0.2	0.3	0.4	0.6	0.7
Fine sands	0	0.3	0.4	0.6	0.7	0.9	1.1
Loamy sands	0	0.4	0.5	0.8	0.9	1.1	1.4
Sandy loam	0	0.5	0.7	0.9	1.0	1.3	1.7
Loam	0	0.2	0.5	0.8	1.0	1.6	2.4
*1500 cbs refers to the permanent wilting point and the soil deficit value is equal to the soil's total available water capacity							

Table 3. Guide for Judging Soil Water Deficit Based on Soil Feel and Appearance for Several Soil Textures

	Soil Texture Classification			
Moisture deficiency in./ft.	Coarse (loamy sand)	Sandy (sandy loam)	Medium (loam)	Fine (clay loam)
	(field capacity)	(field capacity)	(field capacity)	(field capacity)
0.0	Leaves wet outline on hand when squeezed.	Appears very dark, leaves wet outline on hand, makes a short ribbon.	Appears very dark, leaves wet outline on hand, will ribbon out about one inch.	Appears very dark, leaves slight moisture on hand when squeezed, Will ribbon out about two inches.
0.2	Appears moist, makes a weak ball.	Quite dark color, makes a hard ball.	Dark color, forms a plastic ball, slicks when rubbed.	Dark color will feel slick and ribbons easily.
0.4	Appears slightly moist, sticks together slightly	Fairly dark color, makes a good ball.	Quite dark, forms a hard ball.	Quite dark, will make thick ribbon, may slick when rubbed.
0.6	Dry, loose, flows through fingers. (wilting point)	Slightly dark color makes a weak ball	Fairly dark, forms a good ball.	Fairly dark, makes a good ball.
0.8		Lightly colored by moisture, will not ball.	Slightly dark, forms weak ball.	Will ball, small clods will flatten out rather than crumble.
1.0		Very slight color due to moisture. (wilting point)	Lightly colored, small clods crumble fairly easily.	Slightly dark, clods crumble.
1.2			Slight color due to moisture, small clods are hard (wilting point)	Some darkness due to unavailable moisture, clods are hard, cracked. (wilting point)
1.4				
1.6				
1.8				
2.0				



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Resources

- Drip Irrigation for Vegetable Production (and info sources at the end)
- Maintaining Drip Irrigation Systems (Kansas State University)
- Drip Irrigation (Washington State University Small Farms Team)
- Drip Irrigation Web Links (University of Missouri)
- Indiana Irrigation, a Midwestern supplier
- DripWorks, a supplier for small growers
- IrrigationTutorials.com

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To reach us

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